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ABSTRACT

A total of 152 fourth grade students participated in a study examining the effects of visual-only, verbal-only, and combined audiovisual prose presentations and different elaboration strategy conditions on student learning of abstract and concrete prose. The students saw and/or heard a short animated story, during which they were instructed to think of pictures, think of words, draw pictures, write sentences, or use their own strategy to help them remember the material. A 28-item test measured student recall of concrete and abstract prose immediately after and one week after the presentations. The audiovisual group recalled significantly more concrete and abstract information than students in the other groups, while the visual-only group had higher recall of concrete prose than did the verbal-only group. Repeated errors (making the same incorrect response in both the immediate and the delayed tests) were lowest in the combined audiovisual group. The visual-only group made more repeated errors for abstract prose than did the verbal-only group, but this pattern was reversed for repeated errors in concrete prose recall. Students using pictorial elaboration strategies made fewer repeated errors than did students using other elaboration strategies. (Author/RL)

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Effects of Visual and Verbal Stimuli on Children's Learning of Concrete and Abstract Prose

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Effects of Visual and Verbal Stimuli on
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Research on the effects on student learning resulting from different media have proliferated during the past decade. However, the direction of media-related research has shifted from a pursuit of the mythical "best" medium to a more sophisticated investigation of the factors that influence learning from media. The emphasis in much of the current research has shifted from the medium itself to the types of stimuli that constitute the mediated message and the types of learning tasks taught by the message (Salomon & Clark, 1977).

A common approach to investigating the effects of visuals in oral prose learning has been to supplement a verbal presentation with pictures. Levin and Lesgold (1978) have listed several conditions under which pictures facilitate the learning of oral prose: learners should be children versus adults, pictures must overlap with story content, and learning is demonstrated by factual recall. Researchers have generally found that pictures are effective supplements to oral prose when the pictures are well-produced and congruent with prose content and sequence (Lesgold, Levin, Shimron, & Guttmann, 1975; Levin, Bender, & Lesgold, 1976; Pressley, 1977; Levin, Note 3). However, the relative information carrying value of visual-versus-verbal presentations of the same prose content is unclear. Due to differences in research findings (e.g., Rohwer & Harris, 1975 vs. Carey & Whitaker, Note 2) and suspected confounding methodological differences among studies (Carey & Hannafin, Note 1; Salomon & Clark, 1977),

definitive conclusions regarding the relative effectiveness of visual-versus-verbal presentation stimuli are not readily derived from existing research.

The concreteness or abstractness of the information to be learned has been noted to affect the memorability of such information, i.e., the more concrete, the more easily remembered; the more abstract, the harder to remember (Paivio, 1971). However, much of what is known or hypothesized regarding this proposed learning phenomena, has been obtained from serial or paired-associate learning studies. Prose presents several unique learning tasks such as contextual and inferential learning. It is possible, therefore, that patterns of learning concrete and abstract concepts presented via prose could be different from the patterns obtained from non-contextual learning tasks, e.g., the memorability of an abstract concept could be influenced positively by contextual factors, thereby making the concept easier to remember.

The effects of elaboration techniques such as forming mental images have been studied extensively; however, the results of such studies have not been uniform. Since most of the research has focused on constructing mental images or pictures, the relative effects of other information elaboration techniques is unclear. The relative effectiveness of visual-versus-verbal elaboration techniques has received little attention. Also, the comparative effects of covert elaboration techniques such as thinking of pictures or words versus overt elaboration techniques such as writing or drawing words or pictures, have not been studied in-depth.

In the present study student learning of concrete and abstract prose, as a function of different presentations of the prose information and type of elaboration strategy, was investigated. Presentations consisted

verbal, picture, and combined verbal-plus-picture; elaboration levels luded two covert strategies (think pictures and think sentences), two rt strategies (draw pictures and write sentences), and an individualized rsonal learning strategy.

Methods

jects

A total of 152 fourth grade students participated in the study. The dents were attending either of two schools in a predominately middle- ss public school district.

erials and Criteria Measures

Three sets of presentation materials were developed for the study. e presentations were adapted from a children's short story, The Wump rld. The presentations included: ORAL, an audio-only verbal presentation the adapted story narrative; PICS, a 35mm sequenced slide presentation the text illustrations used to depict the story; and ORAL + PICS, a mbination of the narrative and congruent slides. Each presentation was stematically "loaded" with criterion information, i.e., all criterion formation was included in each presentation using verbal labels in the AL presentation, close-up slides of criterion concepts in the PICS sentation, or both in the ORAL + PICS presentation. The presentations, ch were paced identically to control time-on-task, were approximately minutes in duration.

During each presentation seven pauses were embedded at identical ory points. During each pause, students were directed to refer to heir Practice Sheets for directions. The Practice Sheets, numbered 1-5, ncluded a one-sentence synopsis of the preceding story segment and irections to either think of pictures, think of sentences, draw pictures,

write sentences, or "remember the best way you can" to remind them of the events of the preceeding story segment. Students were given two minutes to complete the task in accordance with their elaboration strategy; a brief reminder to complete the elaboration activity was placed one-and-one half minutes into each pause.

The criterion measure was an audio-paced 28-item short answer test. The test, which consisted of 14-abstract items and 14-concrete items, served as a measure of student recall of information presented in the story. The test items measured recall of information or concepts that were systematically presented in both ORAL and PICS presentations. This was done to avoid assessing criterion information for which prior instruction was not systematically provided. The criterion test, which served as a measure of both immediate and delayed recall, yielded several retention scores: immediate abstract, immediate concrete, delayed abstract, delayed concrete, overall abstract, and overall concrete test scores. In addition, two measures of incorrect retention of prose information, an abstract repeated error index and a concrete repeated error index, were derived. The repeated error indexes, which were derived by totalling the number of test items that had the same (or equivalent) incorrect answer on both the immediate and delayed tests, provided a total of test items that were initially incorrectly responded to, and retained as the same incorrect response over time.

Procedures

Standardized test scores, a measure of auditory-language ability, were obtained via the Stanford Achievement test in order to evaluate the groups' pre-study equivalence. Students were randomly assigned to one of the three presentation (ORAL, PICS, ORAL + PICS) groups and one of the five

elaboration (T-PICS, T-SENT, DRAW-PICS, WRITE-SENT, PERSONAL) groups. Within each presentation, all elaboration strategies were included. Students were strategically located in different parts of the presentation room in order to avoid distracting the practice of one elaboration group by the activity of a different elaboration group. Students were given a brief explanation of the nature of the study, and then presented the story.

Students then heard and/or viewed the story, followed by a brief interpolated task consisting of having students stand quietly next to assigned seats, collecting the practice sheets, and distributing answer sheets to students. The audio-paced criterion test was then administered to the students for measures of immediate recall. The test was repeated after two weeks for a measure of delayed recall.

Results and Discussion

Although no significant pre-program differences in auditory-language ability were found, the scores were used as a covariate in the analysis due to the relationship between the scores and criterion test performance and the desire to equalize the groups more effectively. Since all effects were uniform from immediate-to-delayed retention testing, overall screening data has been reported. The overall mean scores for concrete and abstract recall of prose are summarized in Table 1, and the corresponding source data is summarized in Table 2.

Recall of Abstract Prose

As expected, the results of ANCOVA indicated significant main effects for presentation or for recall of abstract prose ($p<.0001$). The ORAL + PICS presentation was uniformly and significantly superior to either the ORAL or PICS presentation for abstract scales ($p<.0001$). No significant differences were obtained between ORAL and PICS presentations for recall of abstract prose. This finding contradicts the conclusions made by

Table 1:

Overall Repeated Measure Mean Scores for Abstract (A)

and Concrete (C) Information by Treatment

		Elaboration Strategy					
Presentation	Scale	T-SEN	T-PICS	WRITE-SENT	D-PICS	PERSONAL	Totals
ORAL	A	5.44	7.40	4.79	6.36	4.89	5.89
	C	5.56	9.45	5.78	7.29	4.17	6.60
PICS	A	5.73	6.04	6.00	4.81	5.71	5.73
	C	7.62	9.09	7.49	7.93	9.00	8.30
ORAL + PICS	A	8.19	7.33	9.38	9.23	9.00	8.67
	C	10.04	8.33	10.22	9.59	10.36	9.77
TOTALS	A	6.60	6.83	7.19	7.24	6.27	6.82
	C	8.06	8.98	8.33	8.39	7.79	8.32

Summary of Effects

Presentation:	Abstract	Concrete
ORAL	5.89	6.60
PICS	5.73	8.30
ORAL + PICS	8.67	9.77

Elaboration:	Abstract	Concrete
T-SEN	6.60	8.06
T-PICS	6.83	8.98
WRITE-SENT	7.19	8.33
D-PICS	7.24	8.39
PERSONAL	6.27	7.79

Note. Refer to Table 2 for effects summary and source data.

Table 2

Source Table for Repeated Measure Mean

Scores for Abstract (A) and Concrete (C) Scales

Source	Scale	df	MS	F	P
Covariate (Achievement)	A	1	1014.64	60.83	.0001*
	C	1	1171.85	97.33	.0001*
Presentation	A	2	567.58	34.03	.0001*
	C	2	504.65	41.92	.0001*
Elaboration Strategy	A	4	11.96	.72	ns
	C	4	44.06	3.66	.01*
Presentation-by-Elaboration	A	8	14.54	..87	ns
	C	8	55.38	4.60	.0001*
Error Term	A	136	16.68		
	C	136	12.04		

several researchers who have concluded that verbal stimuli are inherently more effective than picture stimuli for abstract learning. In addition, no significant differences were obtained among the elaboration strategies, and no significant interactions were found. All effects were uniform from immediate-to-delayed tests.

Recall of Concrete Prose

ANCOVA indicated significant differences among presentation levels for recall of concrete prose. The ORAL + PICS presentation resulted in higher mean performance than either ORAL ($p<.0001$) or PICS ($p<.001$) presentations. However, students in the PICS presentation scored significantly higher than those in ORAL ($p<.0001$). This finding reaffirms the effectiveness of visuals in communicating concrete information to learners. Further, the results extend the findings of non-prose research regarding the effectiveness of visuals to contextual prose learning. Significant elaboration ($p<.0001$) and presentation in by-elaboration ($p<.0001$) effects were also found. The T-PICS strategy was consistently the most effective for both ORAL and PICS presentations groups; however, T-PICS strategies were the least effective strategy for the combined ORAL + PICS presentation group. The most effective elaboration strategy for the ORAL + PICS group was the WRITE-SENT strategy--the PICS group least effective strategy. The different results obtained for concrete-versus-abstract prose recall suggests that recall is differentially affected not only by presentation and elaboration variables, but also by the type of information to be recalled.

Repeated Error Index

The mean repeated error index for concrete and abstract scales by treatment group is summarized in Table 3, with corresponding source data included in Table 4. The ORAL + PICS presentation resulted in fewer

Table 3:

Mean Number of Responses for Which Same Incorrect Response Was Given on Immediate-and-Delayed Tests

		Elaboration Strategy					
Presentation	Scale	T-SEN	T-PICS	WRITE-SENT	D-PICS	PERSONAL	Total
ORAL	A	2.63	1.60	2.71	2.36	2.89	2.40
	C	3.50	1.30	3.57	2.18	4.00	2.80
PICS	A	3.85	3.46	2.75	3.00	3.00	3.28
	C	2.92	2.00	2.63	1.42	1.92	2.23
ORAL + PICS	A	1.77	3.11	2.17	1.69	2.43	2.15
	C	.85	1.33	1.42	2.00	1.29	1.39
TOTALS	A	2.76	2.78	2.48	2.23	2.82	2.62
	C	2.26	1.59	2.33	1.94	2.43	2.10

Summary of Effects

Presentation:	Abstract	Concrete
ORAL	2.40	2.80
PICS	3.28	2.23
ORAL + PICS	2.15	1.39

Elaboration:	Abstract	Concrete
T-SEN	2.76	2.26
T-PICS	2.78	1.59
WRITE-SENT	2.48	2.33
D-PICS	2.23	1.94
PERSONAL	2.82	2.43

Note. Refer to Table 4 for effects summary and source data.

Table 4

Source Table for Repeated Error

Index for Abstract (A) and Concrete (C) Scales

Source	Scale	df	MS	F	P
Covariate (Achievement)	A	1	19.66	7.74	.006*
	C	1	21.29	13.65	.0004*
Presentation	A	2	18.16	7.15	.001*
	C	2	25.33	16.23	.0001*
Elaboration Strategy	A	4	.71	.28	ns
	C	4	4.96	3.19	.02*
Presentation-by-Elaboration	A	8	2.32	.91	ns
	C	8	5.69	3.66	.001*
Error Term	A	136	2.54		
	C	136	1.56		

repeated errors of both abstract ($p < .001$) and concrete ($p < .001$) test items than either ORAL or PICS presentations. A pairwise comparison between the ORAL presentation and the PICS presentation indicated that students in ORAL presentation repeated significantly more concrete prose errors than those in the PICS presentation ($p < .005$); conversely, students in the PICS presentation repeated significantly more abstract prose errors than those in ORAL presentations ($p < .001$). In addition, an elaboration main effect was observed for repeated errors of concrete prose, with T-PICS and D-PICS students demonstrating significantly fewer repeated errors than the three remaining strategies ($p < .05$). A presentation-by-elaboration interaction for repeated errors was found for the concrete scale ($p < .001$), but not for the abstract scale. The pattern of the interaction, however, was not readily apparant or systematic within or between factors. This result suggests that students may not only differentially learn correctly from verbal-versus-picture presentations, but they may differentially repeat errors under each presentation type and retain the erroneous information over time. Again, the difference in patterns suggests that the type of information to be recalled, concrete-versus-abstract, is differentially affected by the type of presentation stimuli, i.e., visual or verbal.

General Discussion

In the present study retention of prose over time was examined from several perspectives. The effect of visual-versus-verbal prose presentations on learning of abstract and concrete prose was examined. In addition, the effects of different overt and covert elaboration strategies on prose learning was investigated. Finally, all data were re-analyzied to probe potential prose repeated error effects. The results indicated that verbal and picture presentations are equally effective in communi-

cating abstract prose to learners. This finding contradicts the research that indicates that visuals, used in isolation from verbal supplements, are ineffective in their ability to convey abstract information. The results further indicate that picture presentations are more effective than verbal presentations in communicating concrete information to learners. Although pictures as supplements have been considered effective for many prose learning tasks, the application of picture-only presentations as a prose medium capable of conveying effectively abstract and concrete information has not been established previously.

The issue of visual media effectiveness may be less a question of the capacity of the media to convey information, and more the manner in which criterion information is, or is not, systematically included. The findings of the present study support the use of well-designed, correlated, and systematically pre-loaded visuals in conveying prose to prospective learners.

The results obtained regarding repeated errors for criterion information, indicating perhaps greater mislearning of abstract prose by students in visual presentations and greater mislearning of concrete prose by students in verbal presentations, is noteworthy. In effect, a common assumption of many researchers, that response errors are random and non-systematic, has been contradicted.

The phenomenon of repeated errors may also be interpretable for perspectives other than those advanced in this paper. While it is inarguable that the probability of repeating a response, whether correct or incorrect, is greater under the original stimulus conditions, the differential effects observed in the present study are potentially meaningful. While students may not actually mislearn initially presented information, recalling instead incorrect initial responses to questions

versus incorrectly recalled information, such effects appear to be primarily and significantly moderated by presentation modality variables. As a possible explanation for this phenomenon, students are required to generate less inference from pictures of concrete objects than from pictures illustrating abstract concepts such as fear, i.e., the potential for mislearning "tree", whether seen or heard, is probably lower than the potential for mislearning the concept of "fear" as illustrated in a visual. Consequently, more mis-inference is likely to occur for abstract-versus-concrete information, when presentations are purely visual. When information is presented verbally, with explicit labelling of concrete and abstract information, less inference is required and less mislearning is likely to occur.

The findings of the present study suggest that long-term learning and mislearning may be differentially affected by the type of information to be learned and the presentation medium. It is possible that what is actually learned from verbal or visual prose may be best assessed by considering both standard-based and standard-free measures of retention, i.e., considering both responses that are "correct" and retained over time and responses that are "incorrect" but also repeated over time. The relative value of a presentation medium might be best determined through an analysis of a learning-mislearning ratio rather than solely by what has been learned "correctly".

Some potential causes for consideration were observed during the study and during the analysis the student responses. All elaboration groups were pooled, although physically segregated as much as possible, during the study. A resulting post-hoc analysis of the Practice Sheets used by the students revealed certain irregularities. Some students

apparently used strategies other than those to which they were assigned, thereby creating possible combined elaboration strategies; however, this phenomenon was considered to be a random occurance for all elaboration groups. The compelling consistency of the findings regarding presentation effects and the magnitude of the observed effects for concrete prose recall suggest that effects and interpretations reported in this paper are well-supported.

Conclusions

The results of the present study provide support for using either verbal or visual presentation stimuli for abstract prose, visual presentation stimuli for concrete prose, or combined verbal-visual presentation stimuli for either concrete or abstract prose. However, mislearning of prose information may also be increased by using visual-only presentations for abstract prose or verbal-only presentations for concrete prose. A primary factor contributing to the effectiveness of presentation stimuli may be the degree to which criterion information has, or has not, been systematically loaded in the different presentations.

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